Copy of the Final Manuscript, submitted to International Journal of Quality and Service Sciences on 02-Mar-2017

Understanding quality – conceptualization of the fundamental concepts of quality

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Abstract

Purpose
The purpose of this study is to challenge to bridge the gap between the problems of the existing quality profession and the existing and emerging challenges of quality with regard to people, organizations, and societies, hence broadening the traditional coverage of quality from the organizations to these three hierarchial societal levels.

Approach
Through professional involvement with researching, developing and practicing quality principles, methodologies and solutions in practice for decades, the authors became convinced that the prevailing conceptual thinking of quality is not based on the valid scientific basis and contains the problem of superficiality. Hence also the practical quality applications are fragmented and vague. As a reaction to the situation, the authors clarify the conceptual essence of quality, its historical background and usage in today's everyday and professional contexts.

Findings and implications
In this article the authors present a solid scientific baseline for the ontological fundamentals of the quality discipline, on which also the epistemological pondering can be built, hence establishing the robust foundation for the practical quality management applications.

Originality/value
This conceptual article is an original research and review paper, contributing to the revival process of the quality profession in its entirety, including quality research, education and practices. The study is based on the authors' multidisciplinary experience, theoretical reflecting and recognized references.

Keywords: quality; quality management; quality improvement; quality assurance; conceptualization; scientific approach; individual; organization; society

Paper type: Research paper

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1 Introduction

Quality is an age-old concept. It has widely been used in professional social and business information and communication, but it also is an everyday and philosophical concept. The word quality is used in many various contexts by engineers, marketing people, business leaders, authorities, lawyers, media, architects, ordinary people, etc. However – even among professionals – we all do not generally seem to be in agreement on the definition of quality.

Hence, this ambiguity results in:

- Uncontrollable fragmentation of quality thinking, discussion and practices.
- Informative interference or problems in professional contexts and superficiality of the quality related information and communication.
- Conceptual confusions between the quality results and quality enablers, and between quality and many other related factors.
- Disintegration of the sound theoretical foundation of the quality profession.

The fragmentation and ambiguity in the professionalization of the quality discipline and its division into many different schools of thought pose conceptual and practical problems affecting harmfully all kinds of quality related practices, including contracts, agreements, research, evaluations, education, standardization, general communication, etc., and in particular quality management and its activities. Confusion is reinforced, because quality is a multidisciplinary concept that has a broad use in the individual, organizational and societal context. If colloquial language substantially differs from the professional language, it will sooner or later cause unnecessary inconvenience. However, profound conceptualization is the prerequisite for the effective communicative exchange in the quality profession.

The authors have studied, implemented and managed quality altogether for years, both in theory and in practice. Hence, based on our multidisciplinary experience and theoretical thinking, in this conceptual original research and review article we consider the essence of the concept of quality, its historical background and usage in today's everyday language and business context. Especially our goal is to ensure the consistency of the ancient, everyday and professional understanding of the quality concept.

The theoretical foundation of this article is Critical Scientific Realism (Niiniluoto, 1999) and its key theses are:

1. At least a part of reality is ontologically independent of human minds.
2. Truth is a semantic relation between language and reality (Tarski, 1944)
3. Science and scientific theories are the best means to create true knowledge from the real world phenomena.
4. The knowledge can continually be refined through the scientific research and by collaboration among the research community.

On this basis we aim at understanding the prevailing situation and proposing the improved conceptualization for the concepts of quality and some other main concepts that are necessary and generally used for practical quality implementations including the concepts of quality

management, quality improvement and quality assurance. We also base our approach on the established terminology and vocabulary practices (ISO, 2000a; ISO, 2000b).

We build our approach on the concepts on the standardized ISO 9000 definition, justify their theoretical (ontological) validity and clarify their suitability for a wide variety of practical situations. Moreover, we want to get the epistemological answers on what we 'do know' and 'can know' about quality and its implementation, which is the foundation for quality measurements and evaluations.

The ambitious purpose of this study was to challenge to bridge the gap between the conceptual and methodological problems of the existing quality profession and the quality anticipation with regard to people, organizations, and societies. With this paper, the authors would like to contribute to the revival process of the quality profession in its entirety, including quality research, education and practices, and the ongoing occupational discussion on the uncertain future of the quality profession (Zairi, in publication 2017).

2 From Antiquity to modern times

Quality is an ancient, and at the same time a very casual and philosophical topic. Both researchers and ordinary people have considered quality related questions for a long time. The concept of quality dates as far back as to Aristotle (Aristotle, 350 BC). His well-known ten *categories* enumerate all the possible kinds of things that can be asked to signify any objects. Quality (ποιόν, **poion**, of what kind, qualified entity) was one of those categories. The word *qualitas* first appeared in Cicero's *Academica* (Cicero, 45 BC) as a Latin equivalent for the ancient Greek word ποιότης, **poiotes** (quality). Aristotle gave two meanings to the word quality: (a) Indicating how an object is distinguished from other objects *and* (b) perception of the object as good or bad[4] (Niiniluoto, 2017; von Wright, 1963).

Quality was seamlessly merged with work skills and results at the time of craftsmanship. The roots of the modern quality profession date back to the time of the beginning of the industrial revolution around 1750. Quality implied producing products to the requirements, process improvement, improving environments of living and working, and patents (Juran, 1995).

Due to the professionalization in the early decades of the 1900's, the quality experts started to draw up formal definitions of the concept of quality (Dahlgaard and Dahlgaard-Park, 2015). This led to many different views and fragmentation, which was enhanced by the richness and variety of the word quality in everyday language. In particular, the interest of the quality experts has been focused on quality questions in the context of organizations and their products to customers.

[4] Although the concept pair of good/evil, referring to ethical human features, is normally used in English translations, in his feedback Niiniluoto suggested to use the word 'bad' as the opposite of 'good', since 'bad' is ethically more neutral and applicable to broader cases. Furthermore, according to von Wright's 'The Varieties of Goodness' 'bad' is the opposite of 'instrumental good'. However, as multidisciplinary researchers we will not in this article try to break into the philosophical meanings of words or the essence of deep philosophical reasoning.

In general everyday language (Oxford Dictionaries, 2015a) the meaning of quality is well aligned with Aristotle's explanation and depicts what the characteristics of an object are, or how the object is perceived in relation to other things. When we associate something with quality, then we normally highlight its positive aspects and success. Quality is a concept that each of us understands subjectively and holisticly. However, if we analyze in more detail what the concept of quality include in various situations, we are faced with a variety of different perspectives and perceptions.

Following Garvin's (Garvin, 1988) ideas we categorize the various meanings of the concept of quality, which have been developed in the course of time, according to the following five groups of definitions:

1) *Product-oriented definitions*, where quality comprises of measurable properties of the product, for example quality is speed, effectiveness, content of gold, etc. The differences in quality follow from differences in measurable properties, and hence it is possible to understand quality objectively. Price and costs can be associated with quality, so that a higher quality means higher production costs. For the same reason, it can be justified that with the high-quality product one can request and receive a higher price. This is how the marketing people often understand the concept of quality.
2) *Production-oriented definitions*, where quality is the fulfillment of and compliance with the requirements. These definitions are used in the traditional quality technology, which has its roots in the manufacture of material products according to the specifications and contracts, and prevention of manufacturing defects. Quality refers to the degree to which a product meets or products meet the specified requirements. Quality is an objective and unambiguously measurable quantity. Guideline in production is to achieve a good (i.e. acceptable) level of quality or faultlessness (zero defects). High production costs can only be avoided by doing all of the work always right the first time. According to Juran and the related comments of Lillrank (Juran, 1990; Lillrank, 2015), one can distinguish two cases:
    a) Small Quality - The goal is faultlessness and managing risks, and the degree the product is manufactured according to the specifications, and
    b) Big Quality - The goal is customer satisfaction and managing uncertainty, and the delivery according to the contract.
3) *The definitions based on the monetary value*, where quality is the monetary value of the object in use, when the object has been acquired for a particular purpose to achieve personal satisfaction or for other reasons. Quality is formed during the manufacture of the product along with the generated value added. In the classical free-market equilibrium, this value added must meet the exchange-value of the product (i.e. the purchase price to be paid). Quality is the ratio of the value in use and price.
4) *Value-based definitions of the real economy*, where quality is the market value of the object. It is the value achieved from the product from fulfilling the needs during its lifetime, no matter what price has been paid for the product (i.e. what its exchange-value is) and how much value added the product represents. In this case, quality is the product's ability to fulfill the needs and expectations, even latent ones, of the user. Quality is bound to the needs of the purchaser and user of the product and, therefore, it is a subjective and time-depending concept. Quality can be assessed only subjectively. A guideline for the production is to collect the best possible information of the customers' genuine and latent

needs and realize the product according to them. Quality does not necessarily mean high production costs. Quality is know-how and customer-driven activities.

5) *Heuristic and mythical definitions*, where quality is superiority, excellence, or luxury. Quality cannot be measured or even defined explicitly. You know what it is. Quality is based on the Platonic ideas. In this way, the concept of quality has been brought up a lot for instance in advertising and activities of 'Excellence'-businesses,

We can note in general that

- The boundaries between the above categories are in no way clear or sharp.
- The definitions are not usually based on clear ontological foundations.
- Ambiguity is typical in many definitions.
- Definitions are mostly related to the quality of product and organizational situations. Modern needs are much broader including quality in the contexts of human individuals, organizations and societies.

In addition to the above mentioned categories of definitions, there is the international standard definition (ISO, 2015a) of the quality concept that has evolved from 1986 and is particularly aimed at all kinds of professional purposes, in business, production, servicing and marketing.

Quality belongs to the basic concepts used in many contexts for characterizing performance of human individuals, organizations and societies. These three intertwined entities are very different in nature, and in modern society the forms of their interactive relationship are very complex. The interacting processes of these entities co-create a wide range of effects and tangible and intangible products that especially are very rich in information content. A compatible quality approach is needed in all these cases at least for consistent professional purposes. Conflict-free professional quality activities require that the definitions of basic quality concepts are unambiguously expressed. This also is the prerequisite for the undisputed quality evaluations. The professional quality language should also correspond to the eclectic character of the concept of quality in everyday language that, however, has a solid historical heritage.

For ensuring the applicability of the definition of the concept of quality in the present complex situations, it is necessary to understand the theoretical foundations of quality. This means the ontological approach, which examines the nature of quality in the terms of existence in reality and the involved elements and their relations. The scientific basis for this approach is to ensure the semantic relationships between thinking, language and reality (Niiniluoto, 1999; Chomsky, 2016; Tarski, 1944).

3 Ontological foundation of the basic concepts of quality

The recognized starting point for our purpose was obtained from the Critical Scientific Realism (Niiniluoto, 1999) and Popper's three-worlds theory (Popper, 1978; Niiniluoto, 1990). Popper’s original theory and its further refined articulation by Niiniluoto (Halonen, 2015, personal communication during 2015-2017) divide the reality into three worlds (Figure 1), which interact with each other:

- World 1: The spatiotemporal world of physical objects and events, including biological entities, matter and energy and their relations

- World 2: The world of conscious minds with perceptions, intentionality and mental states. The world 2 consists of mental objects and events inside both the human beings and certain animals, which includes, inter alia, perception, reflection and awareness of the World 1 entities.
- World 3: The world of the constructions of human mind and communities, which includes, among other things, such abstract objects as propositions, linguistic structures, scientific theories and natural numbers, as well as cultural and social products, such as reports, stories and myths, tools, engineering achievements, social institutions and works of art.

This theory provides us with the possibility to understand, why we do not have unambiguous understanding of the concept of quality; many recognized quality thinkers have created their definitions on the basis of their personal perceptions, experience, subjective knowledge and thinking processes. Most of these definitions were elaborated by individual experts, but the international standard definition is an exception, based on collaboration and evolution during more than three decades.

In our research and in this article also, we use Popper´s theory as the foundation for improving the understanding of the concept quality and expand its applicability for the broader scope including situations related to human individuals, organizations and societies. In these situations, the same general definition of quality should be applied, because today the consistent and professional quality considerations are required for all these areas, which are closely and complicatedly intertwined. This target challenges us to understand, perceive and analyze more comprehensively all the related quality phenomena in the reality.

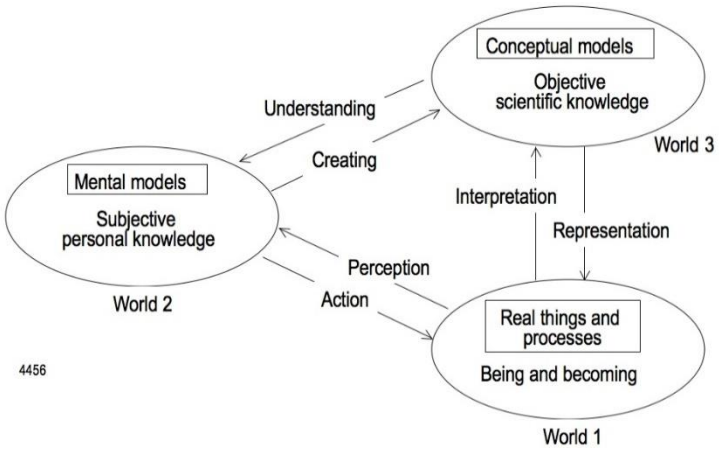

Figure 1. Understanding and conceptualizing the reality according to Popper's three-worlds theory (Hestenes, 1992)

The ontological quality archetype of all quality phenomena in the World 1 comprises the *intentional interactive transaction between two persons with the co-creation and exchange of tangible or intangible entity or thing through which these parties perceive mutual value* (Figure 2). The quality archetype presents the most original pattern of which all the quality objects, their relationships and related concepts and principles are derived, modeled, or emulated, and which explicates all the involved phenomena and events with regard to quality. Hence, the quality archetype is our basis for defining quality and related concepts including quality management,

quality improvement and quality assurance, and it also is the framework for considering measurements and evaluations of quality.

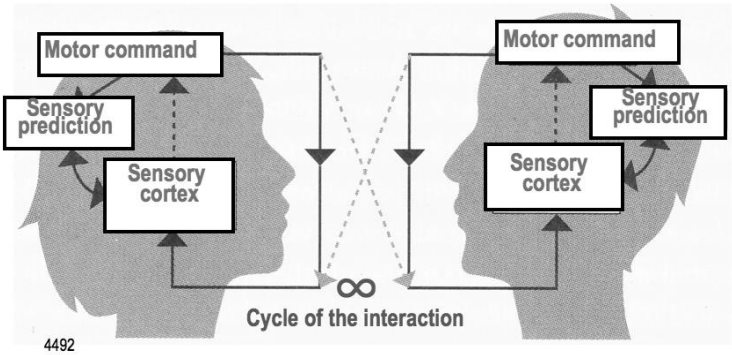

Figure 2. (Hari et Al. 2015; Translated from Finnish). The archetype of the quality phenomena: An intentional interaction of two self-conscious independent persons. A schematic presentation of the action–perception loops of two persons (the cycle of the interaction); in which both of the loops close via the environment (Hari and Kujala, 2009).

The quality archetype (Figure 2) implies the following essential features that relate to the general understanding of the concept quality according to its everyday and ancient meaning:

- Interactivity, intentionality and awareness are intrinsic human properties. Interaction is related with certain needs and expectations of the parties.
- The parties have their own purposes for interaction, and they independently affect and respond to each other and co-create tangible or intangible results (the object) and outcomes of the interaction to both parties. In the business context the object is called product, which includes goods and services.
- The interacting parties perceive the features of the object and realize the degree of satisfaction with regard to their own particular needs and expectations. The purpose of the interaction comes true, when its results satisfy both parties.
- The parties or the expert observers can characterize the perception object by the means of the traditional quality expressions and linguistic descriptions. According to Chomsky (Chomsky, 2016), each human language is essentially an internal, individual and intentional instrument of thought, and a biological property of humans.
- The interaction can take place through technology as extensions of the body and senses (McLuhan, 1964).
- The person-to-person archetype can be extended to the interactions of organizations as manageable systems and processes and societal networks of many independent actors.

Although the characteristics of the object (product) may be pursued objectively, according to our inference, quality always is the percepted subjective knowledge by the minds of the interactiong persons (World 2) from the real world interaction (World 1). Explicitly it can be articulated by the conceptual definition and linguistic description (World 3). The definition can continually be refined through the principles of the critical scientific realism and by the collaborative reflection of people. However, by using different ontological models and theories, one can end up with different undestanding for defining the concept of quality (for example Shewhart, 1931, and Dahlgaard and Dahlgaard-Park, 2015)

Transactions of the parties may also take place indirectly through passive hardware entities (goods) or interactive software services, for example through social media (McLuhan, 1964). In the direct service transactions between the individual persons, our archetypical model is naturally applicable, but by using inductive reasoning it is possible to proceed to the more complicated real world situations related to the organizational and societal interactions. In all of these cases, however, the human activities and their interrelations always have the essential role:

- *Individual persons* are rationally, non-rationally (mentally) (Goleman, 1997) and irrationally (spiritually) (Zohar, 1997) behaving individuals;
- *Organizations* are organized groups of people that have their own functions with responsibilities, authorities and relationships to achieve their objectives (ISO, 2015a) as manageable systems. A single person can be considered as a singular case of an organization;
- *Societies are* aggregates of people and their organizations living together in a more or less ordered community (Oxford Dictionaries, 2015b); societies are not manageable systems like organizations but networks (Barabási, 2002).

Interactions between the entities of individual – organization – society take place in different combinations, including person to person, organization to person,society to person, organization to organization, organization to society, and society to society

However, quality phenomenon and related concepts can be considered in a consistent and compatible way in all these cases and derived from the above described ontological reasoning.

4 From theoretical foundations to practical standardized definitions

4.1 *The concept of quality*

Our archetypical model leads us directly to the understanding and definition of the quality concept. On this basis of the ontological and practical reasoning above we can recognize that the standardized ISO 9000:2015 (ISO, 2015a) definition of quality corresponds to all of the essential features of our archetype model. Hence, the standard definition is suitable and useful for all situations of quality consideration. The ISO 9000 family of standards is the leading international set of standards for quality management, including also the basic concepts, terms and definitions of this field. These standards are the most important and most widely spread references for the professional quality activities and currently are being used in millions of different organizations around the world. The basic definitions of the standard ISO 9000 have developed during more than three decades through the collaborative work of the international quality experts from the different fields of industry.

'The totality of features and characteristics of a product or service that bears its ability to satisfy stated or implied needs' was the first ISO 9000 definition of the concept of quality in the year 1996. During the existence of ISO 9000 family of standards, this definition has been refined, and at present the definition of quality is *'degree to which a set of inherent characteristics of an object fulfils requirements*' (ISO, 2015a), which corresponds to our archetype-related reasoning above. This definition emphasizes the relative nature of quality (‘degree’) that also highlights the subjective perception of quality. The object of quality is defined more generally than for the goods or service products only . The object has its inherent characteristics that consist of all of its

features or attributes. 'Requirement' means here needs and expectations, which may be related to all interested parties (ISO, 2015a) of the object and the interaction. In fact, this definition of quality is also compatible to Aristotle's original explanations, and to the prevailing understanding in everyday language. The standard concepts, terms and definitions, including the relationships between the terms, of the ISO 9001:2015 standard have been created according to the established principles of the terminology work (ISO, 2000a and 2000b).

This definition refers to the needs and expectations of all interested parties in question. In the simple situation of two persons' interaction, this means the satisfaction of the both persons. Satisfaction is based on the persons' rational, non-rational (emotional) and irrational (spiritual) perception.

In the case of an organization, the definition of quality relates to the organization's all stakeholders. With the definition we can consider both the quality of the organization as a whole and the quality of the entities being exchanged between the organization and its stakeholders. Products produced and delivered to the organization's customers are especially significant entities in this context.

In a society, a multilateral exchange of many different kinds of objects takes place between the society members with a great variety of needs and expectations. In this case, we can refer to the quality of the society members (individuals and organizations), the quality of the entities exchanged between the members, and the quality of the society as a whole. Quality of the society is the degree to which the society fulfills the needs and expectations of all human individuals and organizations in the society and the other related societies. Individuals can obtain value from other individuals directly or indirectly via organizations. In this context we also have used the expression 'the quality society' for the society with high quality, i.e. a good, well-functioning, well-developing, or excellent society for all the interested parties involved.

4.2 *The concepts of quality management*

Concepts related to quality management are essential for achieving quality results in a professional way in practice. These concepts – especially quality improvement and quality assurance – have also the ISO 9000:2015 standard definitions (ISO, 2015a) that are compatible with the concept of quality. Also the relationships of the concepts have been defined in the standard. These concepts can also be justified with the archetype model. *Quality management* implies *how the personal, organizational, or societal resourses and activities or processes are managed with regard to quality* (ISO, 2015a). Quality management clearly refers to the case of an organization. In general organizational management consists of activities to direct and control the organization and implies that someone is responsible for it. In the organizations, management in practice consists of normative, strategic, operational and people related managerial activities (Anttila, 2007), which means that also quality activities should be taken into account in all these areas of the general management. In the case of an individual person, quality management is carried out through self-management. Societies cannot be managed like organizations, and hence quality of society is the result of diffusion through the society members' quality management measures.

Quality improvement is a part of quality management, and it concerns the *increasing abilities to meet the needs and expectations of the interested parties* (ISO, 2015a). Quality improvement is achieved through learning and innovation that may be lifelong learning of an individual person, organizational learning and societal learning. Quality improvement of a society consists of the development of the society through *quality diffusion* from influencing activities and interactions of its societal members. Hence, the society and its quality do not evolve quite randomly but they are markedly developed by the interaction and influence by the societal members in networks. Moreover, some researchers have brought up the emergent and teleological features of the whole society (Nagel, 2012).

Quality assurance is the part of quality management that focuses on *providing confidence among the interestested parties* of the object that requirements will be fulfilled (ISO, 2015a). Hence quality management is a communication activity between the parties.

Quality management and its activities are embedded within the organization's general management. That, in particular, involves engagement of the top management to organize quality management according to the purpose of the organization. Organizational management is also tied with the past development of the organization and the business sector in question, and its organizational and societal culture. The complexity of the modern business environment sets challenges for the business management and the quality management (Stacey, 2002). This always influences on the practical realization of quality management. The positive and challenging fact is that some kind of quality management always exists in all organizations, and it can always be improved.

Conceptually quality management is quite clear. However, the vast majority of its implementations is based on the instrumental means of the different methodological schools, which is confusing and detrimental to the understanding the concept itself. In order to obtain an overall understanding of the different practices, we have developed the paradigm mapping (figure 3), which presents a scientific characterization of the different approaches. In all the different cases the same formal definitions of quality and quality management applies.

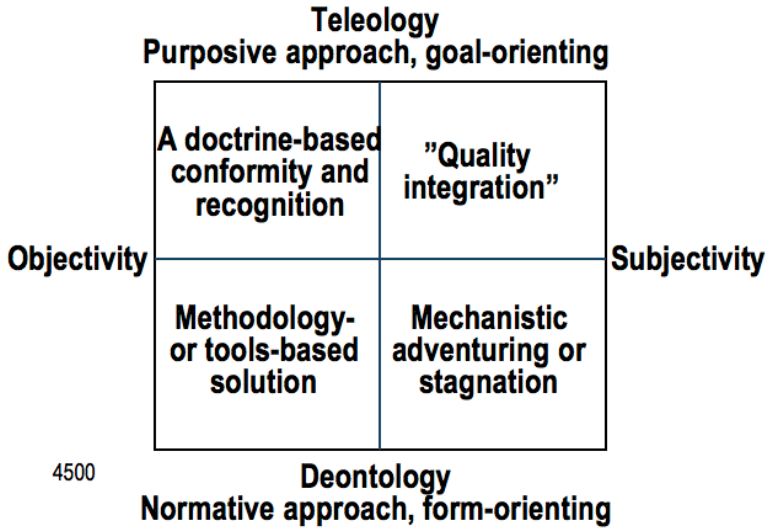

Figure 3. Paradigmatic positioning of the different quality management approaches, contructed by following Burrell and Morgan (Burrell and Morgan, 1979). Our preferred most natural practical solutions to realize the formal definition of the quality management concept are the teleological solutions that strive for the organization-specific quality targets, which we call "Quality integration" and have used in practice.

Objective approaches use generally recognized and well-known models or practices, for instance ISO 9000 standards, performance excellence models, maturity models, SixSigma methodology, lean methodology, etc. 'Deontological' solutions aim at applying a method in a right way for the conformity, for instance establishing and maintaining a formal quality management system according to the requirements of the ISO 9001:2015 standard. 'Teleological' solutions for instance include ISO 9001:2015 certificate or quality award.

Subjective implementations of the quality management use organization-dedicated or tailored means. Deontological implementations often are only an anecdotal approach without any clear targets. We prefer teleological solutions that strive for organization specific quality targets. This approach can also be considered as a natural solution to realize the formal definition of quality management. We have experiences of this approach that we call as 'Quality integration'. In general, the quality integration aims at applying any useful methodologies and can be characterized by:

- Creative systematic, effective and efficient business-integration
- Fulfilling needs and expectations of all stakeholders of the organization
- Continual improvement and refinement
- Strategic and operational performance evaluation and analysis of facts
- Information sharing, organizational learning and innovation

5 Advantages of the scientific foundation and standardized concepts and definitions

Science describes reality through theories. 'There is nothing more practical than a good theory' (Lewin, 1952; Vansteenkiste and Sheldon, 2006). Based on our theoretical basis, we aim at providing ideas for understanding and conceptualizing the complex entirety of the quality phenomena and its details in today's organizational and societal environments. This also creates ideas, which suggests new opportunities for dealing with the relevance and the existing problems of the quality discipline. Conversely, through the practical applications, the variety of the theories is tested, which in turn also leads to the improvement of the theories (Senge et al., 1995).

Einstein expressed that the new type of thinking is essential if mankind is to survive and move toward the higher levels (EMRG, 1946). Hence, we cannot improve our problematic situation at the same level and means as it was arisen. For being successful, Deming required (Deming, 1993) a profound knowledge of the operations and their environment, of the actors involved, of how things fluctuate, change, and develop. Without this, even day-to-day operations will be disrupted. Information is not knowledge, which comes from theory. Without theory, it is not possible to use the data of the instant.

For intervening the course of events, for example for the needs of control and improvement of the processes, we utilize appropriate methodologies and managerial tools. These should also be

based on sound underlying theories (Senge et al., 1995). Through the theoretical foundation we know why the tools function in a variety of practical situations. Hence we also know the limitations of the tools. In addition, in practical cases the application of the theory-based tools leads to the improvement of understanding the situational phenomena.

Managing organizations in practice requires skills and competencies of many different disciplines and scientific knowledge. The modern quality profession has evolved towards a recognized discipline in the course of the recent one hundred years (Juran, 1995). The achievements of the discipline become to public attention through the researchers' presentations and communication, publications and standardization. A radical and fast change of the substantial elements of the discipline is not possible to achieve easily, since disciplines involve a certain degree of permanence. Disciplines are also quite independent by nature and tend to stand out from the other disciplines. However, we know that disciplines have complicated interrelationships. At least today, and increasingly in the future, the existing reality should be considered as a multidisciplinary entirety when approaching the challenges of practice.

The clear scientific foundation of a discipline supports effective collaboration with its partnership disciplines (Kamaja, 2014). The quality discipline has its roots deep in the management sciences and the general administration theory (Wren et al., 2002; Taylor, 1911; Church, 1918). Many specialized management disciplines may be considered as partnership disciplines of the quality discipline. Partnership disciplines produce beneficial ideas, methodologies, tools, etc. to each other. In this sense, operations management, business administration, financial management, environmental protection, sustainability, information security, corporate responsibility, human resource development, health care, statistics, innovation management, etc. can all be understood as partnership disciplines of the quality discipline. As an example, many links exist between the disciplines of quality and information security (Anttila et al., 2008). In some practical cases, the different disciplines may have so close and significant relationships with quality discipline that they should be understood as a part of it. Such a situation may come into question, when business activities are strongly based on modern technologies such as information technology, nanotechnology and biotechnology. This also is aligned with the standardized definition of the concepts of quality and quality management (ISO, 2015a). At present, in many universities the quality discipline may belong to the many different faculties or departments (Savikoski, 2015).

Quality professionals should understand the core issues of the quality discipline and its relationships with the other nearby disciplines in order to avoid considering quality only as one isolated special science (Husserl, 1936). Instead, the practical quality solutions should be multidisciplinary approaches (Kamaja, 2014).

Standardization has a very promising role in publisizing the results of innovative research and development and promoting their appication in practice. Researches have convincingly shown that the macroeconomic benefits of the general international standardization are substantial (DIN, 2000; Blind et al. 2011; Miotti, 2009). Quality and innovation are success factors for the individual organizations, but greater economic benefit is caused through general standardization that distils and diffuses the results and knowledge of quality and innovation broadly to the researchers, experts and organizations.

This article considers the scientific foundation but our ultimate aim is at practical applications. In this context, standardization is an intermediary function between science and practice. Officially standardization is defined (ISO/IEC, 2004) as *an activity giving solutions for repetitive application, to problems existing essentially in the spheres of science, technology and economics, aimed at the achievement of the optimum degree of order in a given context*. Generally, the standardization consists of the processes of formulating, issuing and implementing standards. A standard is the result of the standardization activity, and it is defined as a technical specification or other document available to the public, drawn up with the cooperation and consensus or general approval of all interests affected by it, based on the consolidated results of science, technology and experience, aimed at the promotion of optimum community benefits, and approved by a standardization body.

Standardization is relevant for the quality effectuation, since in general standardization aims at (a) improved business performance and confidence, and quality of products (goods and services), (b) decreased operational costs, and (c) improved communication among people and organizations (ISO/IEC, 2004). Advantages of the general standardization (DIN, 2000; Anttila et al., 2012) result from the broad acceptance and distribution of the standards, extensive expertise in preparing and commenting the standards, wide commitment and recognition, and good possibilities for innovative implementation of the standards through the voluntary ‘crowdsourcing‘ activity of a large global community of qualified experts, researchers and practitioners. The committee ISO/TC 176 (ISO, 2015b) is responsible for the general quality management standardization.

In spite of the many benefits, all general standards also have serious inadequacies, inconsistencies and other problems, mainly due to the normal standardization processes and, in particular, the consensus practices. Organizations applying the standards should highlight the responsibility of their own business leaders and experts and clarify, correct, and complete general standards and for finding creative solutions in their implementations in order to achieve the required/needed business benefits. Awareness of the theoretical foundations of the concepts of quality and quality management can be of great benefit to create practical solutions. This particularly implies applications of the organization-internal standardization (JSQC, 2014). According to the formal definition of standardization, the implementation of standards in organizations is a part of the standardization, and the organizations should take advantage of science, technology and experience incorporated with their own business culture, language and situations.

Taking the ISO 9000 standardization explicitly into account in the context of our research gives us the opportunity to utilize the world wide recognition and applications of the standards for a broader general validation of our research results. Our approach also supports creative application and implementation of the ISO 9000 standards. Our research has proved that the basic terms, the concepts of quality, quality management and quality improvement, and their definitions - as applied in the ISO 9000 standardization - are conceptually sound and practically useful, and aligned with our quality archetype and science-based approach as presented in this article.

6 Performance evaluation

The evaluation of quality and quality management is one of the core issues of the quality professionalism. Theoretically, this leads us to the philosophical area of epistemology, the purpose of which is to find out what we can know, what kind of information is the relevant information in our interest area. According to the critical scientific realism, Popper's World 1 has temporally and ontologically precedence over the knowledge of it. A prerequisite for success of the evaluations is that the constructions of definitions (in World 3) describing and characterizing the entities of interest correspond (Niiniluoto, 1999) to the real world (World 1). Consistently, also the evaluations of quality should be based on the standard definition of the concept of quality. Furthermore, it is necessary to take advantage of the concepts and principles of metrology, the science of measurement.

Measurement means experimentally obtaining one or more quantity values that can reasonably be attributed to the object in question. Especially the concepts of fact, data, information, and knowledge should clearly be understood, and their roles and relationships recognized. Facts represent the reality in the being and action. Through measurements we can get data, and analyzing the data, its meaning and importance with regard to our interest, provides us with information. This information can be the basis for understanding and evaluating the situation and knowledge for actions according to our purpose.

Knowledge is built on theory and theory is a window into the world. Interpretation of data from observations, tests, experiments, evaluations or measurements will largely depend on the pre-knowledge of the subject matter (Deming, 1993). Knowledge and experience of somebody always depends on the paradigm, which he/she follows intuitively or consciously, and is influenced by the three major paradigms (Venkula, 1993; Niiniluoto, 1999):

- Heuristic (true knowledge is based on one's internal comprehension)
- Empirical (true knowledge is based on external observation and experience)
- Pragmatic (knowledge is true if and only if it works satisfactorily)

Too often measurements are carried out in a straight line without a theoretical basis and clear purpose. Hence, it is essential to consider why measurements are needed, what their purpose is, who performs the evaluation and whose interest is considered, and what will be done with the results of the measurements in order to get the benefits of these results. In the organizational context, the needs for quality related measurements cover all operational activities and their management including the effectiveness and efficiency of the enablers (processes and resources) and the development of the achieved results (organization's internal and external performance) (NIST, 2010; EFQM, 2013).

Evaluations are necessary for validating theories and models (Popper's World 3) and for recognizing, controlling and directing being and acting (Worlds 1 and 2). Professional measurements and evaluations may have many different purposes that are essential for quality and quality management, including:

- Researching things for getting new knowledge
- Acquiring information for planning activities
- Controlling operations and processes

- Monitoring performance
- Determinating characteristics of the objects
- Verifying the objects against requirements
- Validating things and objects from their usage point of view
- Acquiring information for problem solving and performance improvement
- Acquiring information for communicating other parties in order to create or strengthen confidence (quality assurance (ISO, 2015a))

Conceptually, the topic of measurements is challenging. Metrology (OIML, 2010) is the science of measurement and its application, and the vocabulary of metrology covers the generally accepted terms and definitions for the whole topic. These general metrological basics may and should also be followed in the measurements and evaluations for the business management and quality management. This requires the following steps:

1. Understanding the phenomena from the business interests and their characters
2. Defining measures or indicators, characteristics, and quantity (metrics, measurement unit)
3. Selecting numerical values and value range of the quantity

After this, one can logically determine practicalities needed for measurements and evaluations and other related actions including (NIST, 2010)

- Targets / required values, observed values
- Meter, gauge, means to measure / observe the quantity
- Measurement technique and process
- Uncertainty of the measurements
- Conclusions, decisions and actions based on measurements
- Approach and practices for using the measurement results, including performance improvement

The term ‘performance excellence‘ (NIST, 2010) refers to an integrated approach to the organizational performance management that results in (a) the delivery of ever-improving value to customers and stakeholders, contributing to organizational sustainability, (b) the improvement of overall organizational effectiveness and capabilities and (c) the organizational and personal learning.

The performance excellence models (quality award criteria) (NIST, 2010; EFQM, 2013) provide frameworks and assessment tools for evaluating the overall organizational performance based on the organizational strengths and opportunities for improvement. Through these measurements we also can get qualitative and quantitative information and knowledge on quality and the effectiveness and efficiency of the quality management.

Performance evaluations may be either strategic or operational (Anttila, and Jussila, 2013). Strategic performance is related to the whole business system and the business vision and strategy, and particular interest is in risk management (ISO, 2009) and large-scale change management. Process measurements and monitoring are typical operational performance management activities. Operational performance evaluations are activities of daily management and are focused on diagnostics and analysis for corrective, preventive actions, and improving

business activities or processes.

In general, two different methodological approaches (ISO, 2009) are available for considering and evaluating the performance of the individual business processes or process systems as a whole (the organizational system): (a) Evaluations based on maturity models, and (b) evaluations based on performance excellence models. The first one is for assessing the performance against certain specified maturity level criteria based on the existing best practices. The latter emphasizes the continual performance growth based on learning, refining, and integrating, and hence it is more proactive to respond to the future challenges. Our preferred approach is option (b).

Performance evalution related to the individuals' quality of life and well-being and the quality of societies are not considered in this article, although the above-mentioned theoretical basis of measurement and improvement are valid also for this case. Effectiveness of the organizational management is always dependent upon the personal characteristics, beliefs, attitudes, and skills of the leading person, including his/her own ambitions, goals and hidden agendas.

7 Conclusions

As long-term practitioners and experts we have ended up to realize the professional basic concepts of quality. Through extensive practical observations and critical and creative reasoning we have justified the definitions of the basic concepts and generally used them in practice consistently. Our aim is to respond to the prevailing ambiguity in the quality concepts and fragmentation in the practices, and hence to refine the body of knowledge of the quality profession. In this way we also want to contribute to the ongoing discussion on the uncertain future of the quality profession.

We have created the quality archetype that can serve as a root model for professional and everyday quality considerations of wide range, including quality phenomena in the context of human individuals, organizations, and societies. Profound quality ontology together with the metrological principles also clarifies and supports the methodologies used for the quality measurements and evaluations.

Our approach anticipates big changes in the organizational and societal environments, when at the same time the organizations have decomposed into smaller and smaller functional networked parts, and the role of individual people and new advanced technologies have been emphasized, responding to the requirements of the fourth industrial revolution (Schwab, 2016). Regarding the quality of human individuals and social networks, our approach provides us with new perspectives to consider the significant and acute questions of the quality of life, and quality of society in a harmonized professional way in addition to the more traditioinal organizational quality questions.

Acknowledgements

The authors would like to thank Ilkka Niiniluoto, Ilpo Halonen and Ilkka Kamaja respectively for their inspiring insights and words of encouragement, and Pal Molnar and Mohamed Zairi for their support and stimulation for our earlier manuscripts about this research. We would also like

to thank Jens Dahlgaard for his valuable comments as Guest Editor of this TQMBE Special Edition and the Members of the Finnish National Mirror Committee to ISO/TC 176 for fruitful collaboration of many years.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors; it was only carried out because of the authors' scientific multidisciplinary interests and desire to clarify the ontological fundamentals of the quality discipline and contribute to the revival process of the quality profession in its entirety.

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